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EDITORIAL.

Fertilizers in Malaya.

The use of artificial fertilizers in Malaya has rapidly increased during the past few years. As recently as the year 1934 the net imports were only 8,745 tons, whereas in 1940 no less than 75,480 tons valued at $4½ million were imported for use in this country.

Malaya, having become fertilizer conscious, is faced with a shortage which may well become even more acute before the cessation of hostilities brings the restoration of normal trade.

Hitherto, imported chemical fertilizers have been used almost to the exclusion of products available in Malaya. The reasons for this preference are self-evident: much of the experimental work upon which manuring programmes are based has been carried out by the Department of Agriculture, the Rubber Research Institute, the advisory services of importing firms, or by planters themselves, using imported fertilizers. Furthermore, chemical fertilizers commend themselves by the ease of handling, the guarantee of quality which they carry, the advisory service which has developed about them, and, until recently, the ease with which they could be obtained. As compared with these advantages, local fertilizers are uncertain in both quality and quantity, prices are apt to fluctuate considerably, handling and transport are usually expensive and the results of application often uncertain.

Despite these disadvantages, it is probable that greater use must be made of them to tide over the difficulty in obtaining adequate supplies from overseas.

Composting will probably receive increased attention and in this connexion the Rubber Research Institute of Malaya through the medium of its *Planters' Journal* has given much good advice. In addition, manurial substances are available in certain parts of the country, although usually in limited quantities; many of the caves in limestone hills contain very considerable quantities of guano, although the quality is variable, while limited quantities of other by-products, such as tobacco dust from local tobacco factories, are sometimes obtainable. Doubtless additional sources of fertilizer material will come to light, and in this connexion we would draw attention to an article in this number which gives information on the production of potassium fertilizer from the waste products of the coconut and oil palm industries. With care in the factory or kiln, the quality of the product can be maintained at a satisfactory level, while the total amount of ash available from these two sources is capable of satisfying a considerable proportion of the Malayan demands for potash fertilizer.

Original Articles.

ASH FROM COCONUT AND OIL PALM WASTE PRODUCTS AS A SUBSTITUTE POTASSIUM FERTILIZER

By

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Introductory.

Owing to the shortness and uncertainty of supplies of potassium fertilizers, required more particularly for rubber growing on the lighter sandy types of Malayan soils which may be deficient in this plant nutrient, attention has been drawn to possibility of partly meeting these requirements by utilizing the ash obtained by incinerating surplus waste materials on coconut and oil palm estates. At present such ash commands a price of $3* per ton per unit of potassium, calculated as K_2O.

The present article gives details of the various waste materials available and of the yields of ash, together with their potassium contents, likely to be obtained, also the values of the different kinds of ash.

The question of the likelihood of an adverse effect on the potassium reserves in the soil is also discussed.

Details of Waste Materials.

The list of surplus waste materials comprises :

(*a*) *Coconuts*
- (i) Husk
- (ii) Shell

(*b*) *Oil Palms*
- (i) Bunch refuse from field
- (ii) Bunch refuse from factory
- (iii) Pericarp refuse from centrifugal extractor or press
- (iv) Nut shells
- (v) Whole refuse (pericarp residue and nuts) from centrifugal extractor or press
- (vi) Freshly screened nuts.

Whole refuse and nuts have been included in the list in view of the fact that, owing to the poor and restricted market for palm kernels, several estates are, as a temporary measure, burning the whole of the refuse from the centrifugal extractor or press. Palm kernel recovery at present prices for the kernels is scarcely an economic proposition.

Table I gives the relevant details of analysis of the different waste materials, together with estimates of the amounts required to produce one ton of the particular type of ash. Although every effort has been made to ensure the accuracy of the figures (in several cases they are based on the results of analyses of similar material from different estates) they can still be regarded only as indications of the amounts that are likely to be obtained. In the case of all the materials listed, wide variations have been found in the amount of ash for similar material from different estates. The type of soil on which the palms are cultivated would appear to exert a considerable influence in this respect. The figure for the proportion of potassium, calculated as K_2O, in the ash does not vary, however, to a marked degree.

* Malayan currency $1 = 2s. 4d.

Table I.

Results of Analysis of Waste Materials from Coconut and Oil Palm Estates.

Details of Waste Material	Moisture	Ash	Potassium (calculated as K_2O)	Proportion of Potassium in Ash	Approximate Value of Ash per ton	Amount of Waste Material Required to produce 1 ton of Ash	Corresponding Amount of Freshly Harvested Material
	per cent.	per cent.	per cent.	per cent.	$		nuts
(*a*) **Coconuts**—							
(i) Husk	31.0	2.84	1.24	43.7	131	62,200 husks	62,200
(ii) Shell	20.2	0.69	0.36	52.2	157	984,000 half-shells	492,000
						tons	bunches tons
(*b*) **Oil Palms**—							
(i) Bunch refuse from field	76.8	2.69	1.25	46.4	139	37.0	92.0
(ii) Bunch refuse from factory	65.0	0.91	0.45	49.4	148	110.0	414.5
(iii) Freshly screened pericarp refuse from centrifugal extractor	50.0	2.55	0.66	25.9	78	39.0	205.5
(iv) Nut shells (air-dry)	10.0	0.93	0.14	15.1	45	108.0	595.5
(v) Whole refuse from centrifugal extractor (calculated)*	32.9	1.66	0.39	24.1	72	60.0	139.5
(vi) Freshly screened nuts	17.4	0.96	0.18	18.8	56	104.0	433.5

* Containing a proportion of bunch refuse, the quantity of this material present in the fruit before treatment being about 10 per cent. by weight. Allowance has been made for this proportion of bunch refuse when calculating the bunch weight in the last column.

As regards coconuts, the figures indicate that both husk and shell yield an ash rich in potassium, the proportion in both cases amounting to about half the quantity of ash. Husks are, however, a much richer source of this element than shells. Compared with husks, between 7 and 8 times as many shells are required to produce the same amount of ash containing approximately the same amount of potassium.

Figures for the proportion of potassium in the ash for oil palm bunch refuse from both field and factory are approximately of the same order as those for coconut husk and shell. There is, however, a large difference in the amounts of the two kinds of bunch refuse required to produce one ton of ash, the bunch refuse from the field having a much higher ash content and being therefore a far richer source of potassium than the factory refuse. The loss in potassium can be attributed to leaching which takes place, particularly in the stems of the bunches, when the latter are sterilized. Reference to an article published previously in this Journal will show that of the different constituents of a bunch the stem contains the highest proportion of potassium(1).

Bunch stripping in the field is seldom practised, the fruit bunches being transported to the factory where they are sterilized. Stripping in the field is usually only adopted in those cases in which a factory is treating fruit from more than one source and as a result of the arrangement transport of clean fruit to the central factory is found to be the most economical method of dealing with the crop on the estate not possessing a factory.

The figures for the proportion of potassium in the ash of either the pericarp residue or of the whole refuse from the centrifugal extractor or press are considerably lower, being only about half those for the bunch refuse. Those for the screened nuts and nut shells are still lower, only about one-third those for the bunch refuse.

Methods of Incineration.

To achieve the best results the waste material should be incinerated at a low temperature and it need not be specially dried before treatment. If the fire is too fierce, in addition to loss of potassium by volatilization, the material will tend to fuse and the ash instead of being powdery or flakey will form small lumps. Potassium compounds have comparatively low melting points and when molten they will react with other substances present, notably silica, yielding mixed silicates. In such combination, potassium is not as soluble and therefore not as readily available to the plant as in the case of an ash resulting from ignition at a low temperature. It is for this reason that the ash from oil palm factory boilers has such a comparatively low fertilizing value(2).

In addition to incinerating at a low temperature, care must be taken to protect the ash from the weather. Potassium compounds are readily soluble in water and are easily leached out by rain. If, therefore, no incinerator is available and the heaps of waste material are burnt in the open, the fresh ash should frequently be removed to a dry shed in which it can be stored until required for bulking. A heavy storm of rain will easily leach out the greater proportion of the potash from a heap of ash left lying in the open.

If possible, the fire should be so arranged that the ash can be collected on a floor that can be kept clean. In the event of the material being burnt on the ground the surface soil becomes dry and powdery with the result that when the ash is collected it is inevitably contaminated with varying amounts of earth, which merely acts as a diluent reducing the potassium content of the material. A suitable arrangement is for the fire to be laid on old iron bars set on brick supports about one foot above the ground. The bars should be set close together to reduce to a minimum the quantity of semi-burnt material falling between. As regards the floor, a concrete one is preferable. Since cement is, however, at present practically

unobtainable for this purpose, the construction of a rammed earth floor overlying old broken bricks or concrete similarly rammed is suggested. Under such conditions contamination of the ash with earth would be very slight.

If large quantities of waste materials are being burnt it may prove an economical proposition to construct an incinerator.

Suggested Design of Incinerator.

A plan of a suitable incinerator for dealing with waste coconut and oil palm refuse is shown in Diagram I. (*See* page 430).

As will be seen the incinerator consists of a roomy enclosed chamber leading to a chimney stack at one end. A hopper is provided to facilitate loading.

Two grates should be provided, a main grate on which the material is burnt and an inclined auxiliary one. The angle of inclination of the auxiliary grate to the main one should be such that the waste material cannot roll quickly on to the main horizontal grate. The arrangement of the two grates is shown in the plan.

The incinerator chamber should be built of brick, preferably lined with one layer of fire-brick or the innermost layer of bricks coated with fire-proof cement.

The grates should be composed of cast iron fire-bars, spaced about half an inch apart.

The hopper should be provided with a sliding shutter and, as will be seen from the diagram, should give direct on to the upper end of the inclined auxiliary grate.

Three doors should be provided :

(*a*) A wide furnace door to allow the material to be raked on the main grate.

(*b*) A small furnace door to permit of attention being given to the fire under the inclined auxiliary grate.

(*c*) A door below the main grate to allow of the ash being raked out.

With regard to the chimney stack, this should be not more than 2 ft. in diameter and possibly 20 ft. high. The height can only be determined as a result of experiment, bearing in mind that the objects of the process are to incinerate at as low a temperature as possible and to avoid excessive condensation of moisture from the waste gases in the stack. If a wide chimney stack is fixed air movement will tend to be reduced with consequent increased risk of condensation of moisture in the stack. In normal times, the chimney stack would be built of mild steel plates. As these are not likely to be available the use of bricks is suggested.

The method of working the incinerator is as follows : A fire is lit on the main grate below the inclined auxiliary grate on to which the fresh waste material is charged through the hopper. This fire need not be large, it should, however, be kept alight continuously. Any dry material, for example, half coconut shells, fragments of oil palm nut shells, pericarp residue, husk refuse may be used for the purpose.

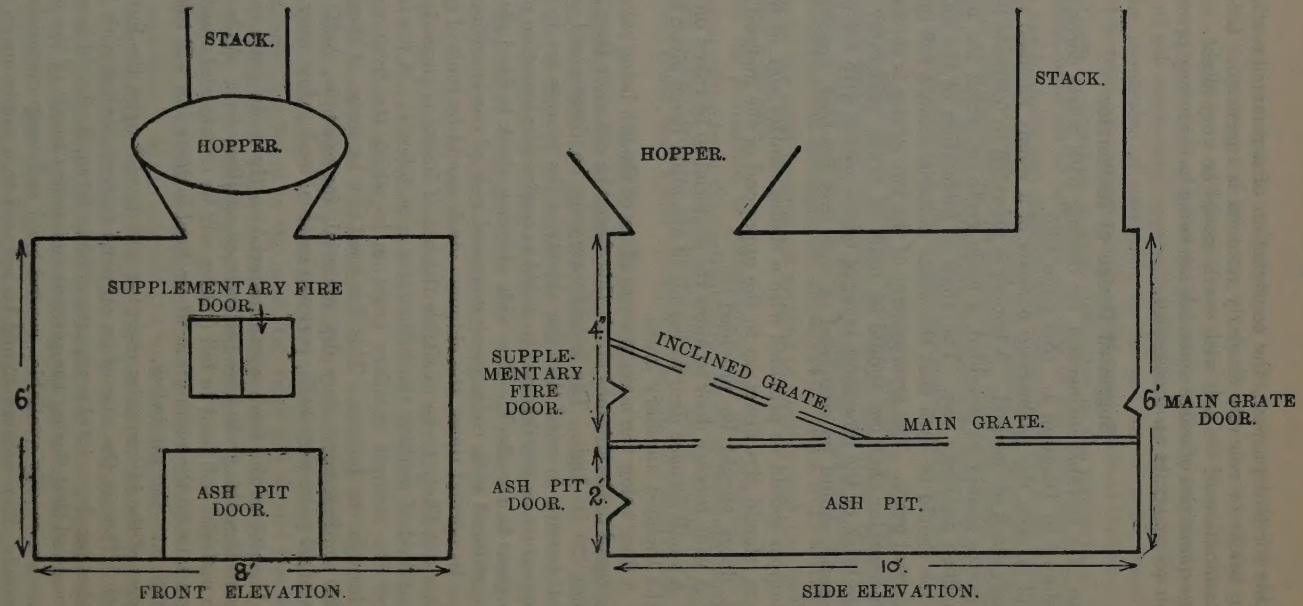
Free burning of the fresh waste material on the main grate should commence at the point where this grate joins the inclined auxiliary one. As burning progresses this waste material will tend to fall (raking will be of material assistance) down the inclined grate on to the main grate where final incineration will take place and the ash will fall into the pit below.

The size of the incineration chamber will depend upon the bulk of material to be handled. Thus in the case of an oil palm factory dealing with 20 to 25 tons of fruit bunches per day a total grate area of 80 to 90 sq. ft. should be sufficient.

It is realized that during the present emergency many of the materials recommended are not readily available, second hand and scrap materials must therefore be improvised. Expenditure should be reduced to a minimum in view of the fact that in both cases the production of ash can only be regarded as a temporary measure.

DIAGRAM I.

INCINERATOR FOR COCONUT AND OIL PALM REFUSE.



Estimated Yields of Ash in Estate Practice.

In the case of a coconut estate no difficulty should be experienced in calculating yield of ash and its value from the data given in Table I since numbers of nuts harvested are recorded.

On an oil palm estate the position is more involved by reason of the existence of alternative methods for dealing with the fresh bunches and of the fact that a varying proportion of the factory waste materials is used for firing the boilers. Further, the ash resulting therefrom is not considered suitable for bulking with that produced from incineration of the balance at the much lower temperature partly on account of the much lower fertilizing value of the boiler ash (previous reference has been made to this point) and partly owing to the fact that it would need to be ground finely before mixing. Grinding would involve additional expense.

To assist oil palm estate managers in forming an estimate of the amounts of ash likely to be obtained according to different methods of treatment of fresh fruit bunches, together with the value of the ash, certain examples, taking as a basis in each case 1 ton of fresh fruit bunches, have been worked out in Table II.

Table II.

Estimated Yields and Values of Ash from Surplus Waste Materials from One Ton of Fresh Fruit Bunches.

Outline of Process and List of Waste Materials	Estimated Amount of Waste Material	Estimated Amount of Ash	Value of Ash	Estimated Amount of Potassium in Ash (calculated as K_2O)	Remarks
1. Bunches stripped in field, fruit treated for recovery of oil and kernels	lbs.	lbs.	$ c.	lbs.	
(*a*) Bunch refuse ..	896.0	24.1	1.49	11.2	Proportion of potassium in mixed ash = 41.1 per cent.
(*b*) Pericarp refuse ..	212.5	5.4	0.19	1.4	
(*c*) Nut shells	203.1	1.9	0.04	0.3	
Total ..	1,311.6	31.4	1.72	12.9	
2. Bunches stripped in field, fruit treated for recovery of oil only					
(*a*) Bunch refuse ..	896.0	24.1	1.49	11.2	Proportion of potassium in mixed ash = 40.8 per cent.
(*b*) Whole refuse ..	481.5	8.0	0.26	1.9	
Total ..	1,377.5	32.1	1.75	13.1	
3. Bunches sterilized in factory, fruit treated for recovery of oil and kernels					
(*a*) Bunch refuse ..	594.0	5.4	0.36	2.7	Proportion of potassium in mixed ash = 34.6 per cent.
(*b*) Pericarp refuse ..	212.5	5.4	0.19	1.4	
(*c*) Nut shells	203.1	1.9	0.04	0.3	
Total ..	1,009.6	12.7	0.59	4.4	
4. Bunches sterilized in factory, fruit treated for recovery of oil only					
(*a*) Bunch refuse ..	594.0	5.4	0.36	2.7	Proportion of potassium in mixed ash = 34.3 per cent.
(*b*) Whole refuse ..	481.5	8.0	0.26	1.9	
Total ..	1,075.5	13.4	0.62	4.6	

In arriving at these figures the assumption has been made that in all cases half the refuse is required for firing the boilers.

The results indicate clearly the particularly valuable nature of the fresh bunch residue as a source of supply of potassium. Thus in the case of the first two examples the ash from this material accounts for between 85 and 90 per cent. of the total ash value.

In those cases, therefore, in which only fruit is despatched to the factory incineration might well be restricted to bunch refuse, the material being burnt in the vicinity of the sheds where the fruit is stripped.

As regards bunches sterilized in the factory the smaller quantity of refuse per ton of bunches can be accounted for by the lower moisture content of the material, while as mentioned previously the reduced yields of ash and potash can be attributed to the leaching taking place when the bunches are sterilized.

A comparison of the figures for values of ash shows that the gross return for the same weight of fresh material harvested is about three times as much when the bunches are stripped in the field as when sterilized in the factory.

Application of Ash as Fertilizer.

Potassium in ash from coconut and oil palm waste material is present in the form of various compounds, for example, potassium carbonate, potassium sulphate, potassium chloride, the first usually predominating. For this reason, the ash should not be applied either immediately before or after sulphate of ammonia, neither should any ash be mixed with this fertilizer. Potassium carbonate and sulphate of ammonia when mixed undergo double decomposition resulting in the formation of ammonium carbonate, which is volatile and decomposes into ammonia gas, carbon dioxide (carbonic acid) and water.

If the material has been incinerated at a low temperature, the bulk of the potassium in the ash is water-soluble so that it is unnecessary to turn the ash into the soil, surface sprinkling is sufficient.

Possibility of Adverse Effect on Potassium Reserves in Soil.

On some coconut and oil palm estates, all surplus waste materials are returned to the soil with the object of maintaining the supply of plant nutrients at the highest possible level. Examples of this are the spreading and ploughing in of coconut husks between the rows of palms and the composting of oil palm bunch refuse from the factory for subsequent incorporation into the soil around the palms. Both these operations conform to sound agricultural practice.

Although the present article has not been written with the object of discussing whether such a policy should be abandoned in favour of one which seeks to secure a temporary additional revenue at the expense of depleting the soil of its plant nutrients, particularly potassium, the following observations dealing with this aspect of the question will be of considerable interest to those estate managers who may be in doubt on this point. In this connexion it must be pointed out that the figures given must only be taken as a guide ; as pointed out previously there may be wide variations in the potassium content of similar waste material from two different estates.

Rate of Depletion on Coconut Estate.

Based on the analytical data published previously in this Journal ([3]) and assuming no potassium manuring programme the average amount of potassium, calculated

as K_2O, involved when the nuts are picked is 78.5 lbs. per acre per annum. This amount is distributed as follows :

	lbs.
Husk	47.1
Shell	7.1
Meat	17.1
Milk	7.2
Total ..	78.5

If the husks are being returned and ploughed into the soil, the rate of depletion of potassium, calculated as K_2O, works out at 31.4 lbs. per acre per annum. It is admitted that this figure is slightly on the high side, since it takes no account of the return of the shell ash to the land. This is a recognised practice on many coconut estates. The potassium in the meat and milk are, however, total losses.

Assuming 50 palms per acre, an amount of 31.4 lbs. is equivalent to a dressing of rather more than 0.6 lbs. of potassium calculated as K_2O, or about 1.25 lbs. of sulphate of potash per palm per annum.

If the husks are burnt, the rate of depletion will be increased by a further 47.1 lbs. of potassium, calculated as K_2O, per acre per annum, which on a basis of 50 palms per acre is equivalent to a dressing of about 2 lbs. of sulphate of potash per palm per annum.

On a basis of 50 palms per acre, a total rate of depletion of 78.5 lbs. of potassium, calculated as K_2O, per annum is equivalent to a dressing of about 3.25 lbs. of sulphate of potash per palm per annum.

Most coconut estates in Malaya are situated on the coastal clay soils, which are normally rich in potassium, the total amount of this plant nutrient in the soil being of the order of 0.8 per cent., calculated as K_2O.

Taking the conventional factor for weight of soil as 1,000 tons per acre foot the total potassium content of the first 12 ins. of soil is about 8 tons per acre. Assuming only 10 per cent. of this amount to be available for the palms the corresponding figure for the available potassium, calculated as K_2O, is 1,792 lbs. per acre.

Assuming therefore none of the potassium present in shell, meat and milk are returned to the soil the rate of depletion of potassium in respect of the total available present is rather less than 2 per cent. per annum, while if the husks are burnt the rate is increased to about 4.5 per cent. per annum.

From the above data, and bearing in mind that no response to potassic manures has been obtained in the case of coconut palms growing on such soils, it is not considered that incineration of husks will have, over a period of a few years, any appreciable adverse effect on the palms as far as removal of additional potassium is concerned.

Rate of Depletion on Oil Palm Estate.

In the case of an oil palm estate, the nature and amount of the waste materials will depend on whether bunch sterilization is the first stage of the factory process or whether the fruit bunches are stripped in the field and only fruit with about 10 per cent. by weight of trash is brought to the factory for treatment. As mentioned previously, bunch stripping in the field is usually only practised in the case of estates not possessing a factory.

Based on the following conventional factors :

Output of palm oil per acre	15 cwts.
Recovery of palm oil on weight of fresh bunches	15 per cent.

Weight of fresh bunches per acre .. .. 5 tons
Proportion of fruit to bunch .. .. 60 per cent.

and the analytical data published in this Journal (1), and assuming no potassium manuring programme, the average amount of potassium, calculated as K_2O, involved in harvesting fruit bunches is 71.7 lbs. per acre per annum. This amount is distributed as follows :

	lbs.
Stem	48.0
Branches	7.9
Pericarp	11.5
Shell	2.3
Kernel	2.0
Total ..	71.7

(*a*) *Bunch Sterilization.*—Based on the analytical data for oil palm bunch residue and pericarp residue published in " The Oil Palm in Malaya " (2), it can be calculated that the soil on an estate, on which the bunch refuse from the factory is composted in the field for subsequent incorporation into the soil, is being depleted approximately at the rate of 58.4 lbs. of potassium, calculated as K_2O, per acre per annum. This amount is distributed as follows :

	lbs.
Pericarp residue	10.8
Shell	2.3
Kernel	2.0
Condensate from bunch sterilizer and waste water from purification of oil (by difference)	43.3
Total ..	58.4

An interesting feature of the above figures is the relatively large loss of potassium occurring through leaching at different stages of the factory process. Previous reference has been made to the leaching from the bunches, particularly the stems, during bunch sterilization, while attention is drawn in " The Oil Palm in Malaya " to the potassium content of the waste water resulting from the washing of the crude oil (2).

Assuming there are 55 palms per acre, the amount of 58.4 lbs. given above is equivalent to a dressing of rather more than 1 lb. of potassium, calculated as K_2O, or about 2 lbs. of sulphate of potash per palm per annum.

If the bunch refuse is incinerated, the rate of depletion will be increased by a further 13.3 lbs. of potassium, calculated as K_2O, per acre per annum, which on a basis of 55 palms per acre is equivalent to a dressing of say 0.5 lbs. sulphate of potash per palm per annum.

A mixture of pericarp residue and shell is used as fuel for the boiler in an oil palm estate factory and the above calculation assumes the whole of these waste materials produced is required for that purpose. This assumption is, however, not in accordance with estate practice. On large estates the amounts of pericarp residue and shell are in excess of fuel requirements (only about 50 per cent. of the total amount available is usually required for this purpose) so that the figures for the losses of potassium in respect of these two constituents may be taken as maxima. On the other hand, pericarp residues and shell surplus to fuel requirements are seldom

returned to the land (the shells are frequently used as ballast for the light railway on the estate) so that based on usual estate practice the figures given above may be accepted as average as far as rate of depletion of potassium reserves in the soil is concerned.

(*b*) *Stripping of Bunches in Field.*—By stripping the fruit bunches in the field, only transporting fruit (admixed with 10 per cent. by weight of trash) to the factory and returning the fresh bunch residue to the soil the rate of depletion of potassium reserves therein can be reduced considerably as the following distribution figures, based on the conventional factors and the analytical data to which previous reference has been made, show.

	lbs.
Remaining in Field.—	
Stem	48.0
Branches	1.9
Total	49.9
Transported to Factory.—	
Branches	6.0
Pericarp	11.5
Shell	2.3
Kernel	2.0
Total	21.8
Grand Total	71.7

In drawing up the above distribution, the assumption has been made that the bunch trash mixed with the fruit consists entirely of fragments of branches. This is considered reasonable in view of the fact that there is in the bunch an excess of branch material over and above that required to provide 10 per cent. by weight of that of the fresh fruit, while the manner in which the bunches are chopped when removing the fruit, that is by severing the branches from the main stem, suggests that by far the greater proportion of the trash will consist of branch débris.

Based on the figures given under (*a*) the final distribution of potassium for the fruit treated in the factory would be approximately as follows :

	lbs.
Pericarp residue	10.8
Shell	2.3
Kernel	2.0
Condensate from sterilizer and waste water from purification of oil (by difference)	6.7
Total	21.8

Assuming there are 55 palms per acre, an amount of 21.8 lbs. is equivalent to a dressing of a rather less than 0.4 lbs. of potassium, calculated as K_2O, or about 0.75 lbs. of sulphate of potash per palm per annum, which corresponds to a 60 per cent. reduction on the calculated dressing in the case of bunch sterilization.

A comparison of the figures for coconuts and oil palms will show that the potassium figures involved are of the same order, 78.5 lbs. for coconuts and 71.1 lbs. for oil palms.

Unlike coconuts, oil palms are not confined to the coastal clays, they have been planted on a variety of soils, including various inland types, some of which are low in available potassium compared with the coastal clays (4).

Experiments conducted by this Department on oil palms have shown to-date no response in yields to potassic fertilizers applied as muriate or sulphate of potash(5). Preliminary observations on palms at the Central Experiment Station, Serdang, indicate, however, that patent kali* in addition to having a beneficial effect on wilting and bronzing of the leaves may have a similar effect on yield of fruit.

For the present, therefore, managers of oil palm estates, especially those on inland soils, are advised not to manufacture ash for sale, unless wilting or bronzing of leaves is absent and it is also known from experiments that applications of potassic fertilizers have had no beneficial effect as regards increasing yields of fruit. In all other cases the ash or its equivalent in fresh material should be returned to the soil.

Conclusions.

The results indicate that coconut husks and oil palm bunch refuse from the field are the best sources of potassium. Oil palm bunch refuse from the factory has a much lower potassium content due to leaching out of potassium compounds during the bunch sterilization process.

2. The importance of incinerating at as low a temperature as possible and of keeping the ash dry is emphasized.

3. In the case of coconut palms cultivated on coastal clay soils, it is not thought that incineration of husk would have, over a period of a few years, any appreciable adverse effect on the palms as far as removal of additional potassium is concerned.

4. Oil palm estate managers are advised for the present not to manufacture ash for sale unless wilting and bronzing of leaves is absent and unless experiments have shown on the particular type of soil the application of potassic fertilizers to be without effect as regards increasing yields of fruit.

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(4) Dennett, J. H. The Classification and Properties of Malayan Soils. *Malayan Agricultural Journal*, Vol. XXI, No. 8, August, 1933, page 347.

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* Patent kali is a proprietary fertilizer containing both potassium and magnesium.

CONDITIONS ON RUBBER SMALL HOLDINGS IN MALAYA

3rd Quarter, 1941.

Prepared by the Economics Branch of the Department of Agriculture, Straits Settlements and Federated Malay States, in collaboration with the Field Branch of the Department.

Rainfall.

With a few exceptions, weather conditions throughout the Peninsula approximated to normal, i.e., July was fairly dry, rain increased in August, and September was wet in most Districts.

In Selangor, at Bagan Datoh and Tapah in Perak, and at Kluang in Johore, the July rainfall was above the average. In Selangor, Kelantan and Pahang, the month of August was drier than usual. Perak North Circle experienced exceptionally heavy rain in September, the rainfall at Taiping being the highest for September ever recorded there and almost double the average. The north-east of Kedah, Mersing, Johore, and Pekan, Pahang have experienced unusually dry weather throughout the quarter.

Prices.

Owing to the stabilization of the general market price, prices paid for small-holding rubber have remained remarkably steady throughout the quarter, although on a rather lower level than those ruling in the previous quarter. Tables I and II summarize the position during the period under review.

Throughout the country, coupon values declined strongly, opening in most Districts in the region of $21 per picul equivalent but falling rapidly during the latter half of the quarter to $4 or $5 in most areas and to $1 only in Johore. In consequence the prices of uncouponed rubber rose considerably during August and September and in Selangor and Malacca uncouponed smoked sheet sold for as much as $38 per picul without coupons.

Production and Tapping.

Table III shows the production of rubber on small holdings during the quarter. It will be seen that there was a further increase in the total for the quarter, so that the figures for the year now compare favourably with those for 1940.

The results of the usual quarterly survey of small holdings are given in Tables IV and V. The decrease in the percentage of holdings out of tapping recorded during the previous quarter continued. The high quota release and the high prices of uncouponed rubber more than offset the incidence of rain, the difficulty of obtaining coagulants and the fact that in some parts of the country the men were still at work in the padi fields. Not only was there a rise in the number of tapped trees but intensive tapping was continuous and widespread. Excessive tapping was reported from Malacca, Negri Sembilan, the Perak Central and Johore North Circles, particularly on Malay holdings worked on the *bagi dua* system.

This increase of tapping led to labour difficulties as labourers demanded high wages and in Selangor many were being paid 13 to 15 cents per kati of dry rubber. In Perak, skilful tappers could earn $3 a day but many have gone to southern Thailand where wages are still higher. There has been considerable friction between Malay small-holders on the *bagi dua* system and their Chinese tappers, both sides demanding a higher proportion of the profits. As a result, family tapping on Malay holdings has increased and in the North Circle of Perak, where the men are still in the padi fields, the women and children did the tapping.

Table I.

Lowest and Highest Rubber Prices Paid by Local Rubber Dealers.

(*In Malayan dollars per picul of 133 1/3 lbs.*)

3rd Quarter, 1941.

Quality	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore	Kelantan
				JULY					
Smoked sheet ..	45.00-47.50	38.00-46.60	44.00-46.00	44.00-46.00	39.00-46.00	45.50-47.00	39.50-45.60	41.50-45.50	40.00-44.30
Unsmoked sheet ..	44.00-46.00	35.00-45.00	41.00-43.50	41.00-45.00	38.00-43.00	43.50-45.80	41.00-44.40	36.00-53.50	39.00-42.50
Scrap	29.00-32.00	30.00-32.00	31.00-32.00	—	—	29.50-33.00	29.00-33.00	12.00-33.00	21.50-30.00
				AUGUST					
Smoked sheet ..	45.00-47.50	38.00-46.00	42.00-45.25	42.00-46.00	41.00-45.40	46.00-47.50	39.50-45.50	40.00-54.20	40.00-43.80
Unsmoked sheet ..	43.50-46.00	35.50-44.50	41.60-42.60	40.00-44.00	38.00-43.50	44.00-45.56	41.00-44.00	30.00-44.50	38.50-42.00
Scrap	26.00-31.00	30.00-32.00	30.00-32.00	—	—	28.00-33.00	26.00-32.00	14.50-31.00	20.00-29.00
				SEPTEMBER					
Smoked sheet ..	45.00-47.50	37.00-45.00	43.00-46.00	43.00-45.30	40.00-45.40	45.50-47.15	39.50-46.00	41.00-45.50	39.50-43.60
Unsmoked sheet ..	44.00-46.00	35.00-44.00	40.00-44.00	39.00-44.00	37.00-43.00	43.00-45.00	41.00-44.00	38.20-44.50	38.00-42.00
Scrap	25.50-30.00	30.00-32.00	30.00-32.00	—	—	28.00-30.00	26.00-32.00	16.00-39.00	15.50-28.50

Table II.

Mean of Lowest and Highest Rubber Prices Paid by Local Dealers at a number of Centres in each State.

(*In Malayan dollars per picul of 133 1/3 lbs.*)

3rd Quarter, 1941.

Quality	Penang	Perak	Selangor	Negri Sembilan	Pahang	Malacca	Kedah	Johore	Kelantan
				JULY					
Smoked sheet ..	46.00-47.25	42.80-44.66	44.18-45.08	44.10-45.38	43.05-44.42	46.00-46.77	43.32-45.40	43.58-44.50	41.75-43.90
Unsmoked sheet ..	44.75-45.62	40.44-42.91	41.75-42.75	41.88-43.28	40.60-42.04	44.17-45.10	41.17-43.35	41.64-43.50	40.25-42.00
Scrap	30.67-31.17	30.00-32.00	31.00-32.00	—	—	29.83-31.50	29.66-31.00	25.41-27.64	24.50-26.50
				AUGUST					
Smoked sheet ..	46.00-47.25	42.87-44.88	43.78-44.44	43.50-45.36	42.94-44.52	46.17-47.17	43.20-45.12	42.56-45.23	41.75-43.40
Unsmoked sheet ..	44.38-45.38	39.93-43.00	41.40-42.98	41.25-43.05	40.80-42.15	44.17-45.17	41.50-43.12	39.55-42.40	40.00-41.00
Scrap	28.00-29.33	30.00-32.00	30.00-32.00	—	—	29.33-31.17	27.66-31.33	20.81-25.39	23.50-25.00
				SEPTEMBER					
Smoked sheet ..	46.00-47.25	43.08-44.68	44.12-45.02	43.88-45.08	43.05-44.18	45.83-46.88	43.50-45.47	42.95-44.40	41.40-43.05
Unsmoked sheet ..	44.50-45.38	39.80-42.35	41.35-45.65	40.25-42.75	39.80-41.68	43.50-44.83	41.50-43.50	37.05-39.46	39.75-41.00
Scrap	27.30-29.67	30.00-32.00	30.00-32.00	.. —	—	28.50-29.83	27.66-29.66	22.19-26.67	20.00-22.60

Table III.

Production of Rubber on Small Holdings.

(In tons)

	Total Jan. to Sept. 1940	1st Quarter 1941	2nd Quarter 1941	3rd Quarter 1941	Total Jan. to Sept. 1941
Federated Malay States ..	79,252	19,432	27,211	28,193	74,836
Straits Settlements	11,579	3,944	4,952	4,836	13,732
Unfederated Malay States ..	73,108	22,536	29,387	29,129	81,052
TOTAL MALAYA ..	163,939	45,912	61,550	62,158	169,620

Table IV.

Estimated Acreage of Tappable Rubber which was out of Tapping on Holdings of less than 100 acres at end of September, 1941.

State	Total tappable area (acres)	Total area untapped. End Sept. (acres)	Per cent. untapped. End Sept.	Per cent. untapped. End June, 1941.
Perak	271,965	25,100	9	14
Selangor	145,193	21,200	15	19
Negri Sembilan	97,597	22,300	23	38
Pahang	84,588	19,500	23	23
Total F.M.S. ..	599,343	88,100	15	20
Malacca	70,217	13,100	19	25
Penang & Province Wellesley ..	39,092	5,400	14	18
Singapore	20,115	1,000	5	4
Total S.S. ..	129,424	19,500	15	20
Johore	350,007	10,500	3	6
Kedah	102,126	4,100	4	7
Kelantan	49,133	10,300	21	23
Perlis	2,916	3,600*	11*	15*
Trengganu	29,836			
Total U.M.S. ..	534,018	28,500	5	8
Total Malaya ..	1,262,785	136,100	11	15

* Estimated from percentage for rest of Malaya.

Table V.

Comparisons of Areas of Rubber Small Holdings Out of Tapping.

	September, 1940		June, 1941		September, 1941	
	Acres	Percentage	Acres	Percentage	Acres	Percentage
F.M.S.	139,000	23.0	120,800	20.0	88,100	15
S.S.	35,400	27.4	25,500	19.7	19,500	15
U.M.S.	47,400	8.8	44,300	8.3	28,500	5
Malaya ..	221,800	17.6	190,600	15.1	136,100	10.7

In some areas of Negri Sembilan the *bagi dua* system is being replaced by a system called *pajak* (farming monopoly) whereby the lessee provides the labour, coagulant and utensils, while the lessor receives a fixed quantity, often as little as 25 per cent., of the dried rubber produced. Marketing under this system is the affair of the lessee only.

Quality of Rubber and General Conditions on Holdings.

It is reported from Kelantan that there has been a tendency towards reduction in the quality of rubber produced for sale. The high price of uncouponed rubber has induced producers to sell quickly to take advantage of the market, with the result that the use of co-operative smokehouses has been considerably reduced. Furthermore, itinerant and, often, unlicensed middlemen are giving high prices for poor quality rubber and no premium for better sheet.

In Selangor, on the other hand, the quality of the smoked sheet has continued to improve and an interesting experiment in grading and co-operative marketing in Beranang and Jenderam has every appearance of being successful. Here dealers who do not own smokehouses pay a premium of from $2 to $3.75 per picul. The scheme is rather naturally discouraged by dealers owning their own smokehouses. The latter prefer conditions like those obtaining in Malacca where smoking of rubber sheet remains the work of Chinese dealers, who smoke all their purchases before resale to big dealers in Malacca. The difference in price between smoked and unsmoked sheet is too small to induce the small-holders to smoke their own.

Throughout the country measures taken to prevent soil erosion appear to have been satisfactory. Only from the Central Circle of Perak is there a report of increased erosion and this only in conjunction with increased rainfall and on old areas of sloping land. Cover crops on the replanted land in these areas are generally adequate but there is some trouble in those areas which have been terraced " off the contour ".

It is reported from the North Circle of Johore that in the large blocks of new rubber planted in 1939 under the New Planting Scheme the question of the control of soil wash is receiving adequate attention and the covers are being well maintained. In this connexion the Asiatic Rubber Instructors have given material help and numerous orders for cover crop seed have been made through the Agricultural Officer.

Similarly in Pahang the small-holder seems prepared to take steps against soil erosion. Some old holdings with absentee landlords still clean weed but on the majority of holdings a good natural cover is allowed to develop and terracing is generally undertaken where necessary. The holders in this State have also improved in their treatment of new and replanted holdings.

From Perak Central Circle it is reported that a greater amount of weeding and slashing is now being done. In Malacca also the Chinese and Chettiar owners are clearing the *lalang* grass and secondary jungle but the condition of the Malay holdings still leaves considerable room for improvement.

On small holdings manuring has yet to receive the attention it deserves but it is reported to be the practice on Chinese and Indian holdings in Selangor, and in that State there is also an improvement on Malay holdings in this respect. In Pahang, manuring with cattle and poultry manure or compost is being carried out by some Chinese at Gambang.

Planting and Budgrafting.

Throughout the Peninsula, interest in replanting was meagre. Landowners who were about to replant have decided not to cut out this year, giving as their reasons the low price of coupons, the difficulty of securing labour, and the scarcity of fencing materials.

In areas already replanted, budding was carried out as the stands came of age. In most areas the free clone Tj. I continued to be the most popular. In the Johore Central Circle 76 acres have been budded ; in the South Circle 122 yds. of budwood have been distributed ; and in the North Circle 200 yds. of Tj. I and a few yards of Pil. B 84 have been sent out from Tangkak Agricultural Station. In Province Wellesley 161 yds. of Tj. I and 182 yds. of Tj. 16 were sold from Bukit Mertajam Station. Clonal budwood was available from Selama in the North Perak Circle and some orders were booked. In the Central Circle of Perak the demand for budwood increased and 600 yds. of budwood and 169 budded stumps were distributed in addition to 940 yds. of budwood sent to the Sungei Manik Nursery. In Selangor, a total area of 3,199 acres of Chinese holdings has been budgrafted and 223 acres have been planted with clonal seed. The figures for Malay and Indian holdings in the State are not yet available.

Many of the orders for budwood in the various areas have been placed through the Asiatic Rubber Instructors, who have then supervised budding operations.

In most areas where budding is undertaken by contractors, the price for successful budding increased. In Selangor the budding contractors were charging from 3 to 3½ cents per success, whilst in North Pahang the fee for a successful budding rose from 8 to 10 cents.

Pests and Diseases.

With the advent of more rainy weather the incidence of Mouldy Rot Disease increased. In many States this was in no way abnormal, but in some areas in Kedah, Province Wellesley, and the Central Circle of Perak, it was more severe, probably having been aggravated by overtapping and by tapping in the rain. Approved proprietory insecticides were sold by the Department or by Asiatic Rubber Instructors in many Districts to check this disease.

Root disease is still reported from various parts of the Peninsula, particularly from Pahang, Johore, Selangor, and the Central Circle of Perak, where the replanted areas in Parit and the Dindings are suffering. *Fomes Lignosus* in Pahang was treated with 2 per cent. copper sulphate. This was also used in Selangor.

Some Pink Disease has been found near Raub in Pahang, and a few cases have also been reported from one centre in Johore Bahru District.

Animal pests were not sufficiently serious for comment, with the exception of white ants in the Central Circle of Johore and pigs and monkeys in the Lipis and Temerloh areas of Pahang. The marauding elephant at Tanjong Besar in that State has now been shot.

General.

The increase of tapping has led not only to a shortage of labour but also to an aggravation of the shortage of coagulants. The acid shortage has been serious and judging by the difficulty which the Department itself had in obtaining stocks from the importers, the scarcity was real and not artificially produced by dealers.

In all areas prices have been well above the gazetted maximum and there have been reports of discrimination by smaller dealers against customers. Police action is being taken in cases of blatant profiteering.

Various substitutes for acetic acid have been used. These include fermented coconut water, widely used in the Coast Circle of Selangor, and alum or alum and acid, particularly favoured in Johore. In Pahang, one estate used sodium silicofluoride.

In many Districts the Department has helped to ameliorate the position by buying and redistributing acetic acid, but the re-introduction of rationing was clearly necessary and this was brought into effect on 1st October.

Demonstration replanting areas have been established under the auspices of the Rubber Research Institute at Temerloh. The area has been felled and burned and a cover crop is being established. Three demonstration replanting areas have been selected by the Asiatic Rubber Instructors in Selangor and have been approved. The Malay Rubber Instructor, Taiping, has selected a small holding near Trong as a demonstration replanting area. Budding will be undertaken during October with budwood from Selama Agricultural Station.

A party of 7 Malays in charge of one Asiatic Rubber Instructor visited the Rubber Research Institute Experimental Station at Sungei Buloh and the Central Experiment Station, Serdang, during the August Bank Holiday.

A small-holders' rubber competition was held in Ulu Selangor in August. There were 70 exhibits and the general quality was good.

The Rural Lecture Caravan toured certain centres in Lipis, Pahang, during September and lectures on rubber topics were given.

Abstract.

The Domestic Buffalo.

The river and the swamp buffalo form the subject of a most informative article published in *The Veterinary Record** by Mr. R. Macgregor. Space forbids more than a passing reference to several aspects of the author's article, including Zoological Classification and Notes on Anatomy and Physiology. In view of the fact that both the swamp and the river buffalo find their place in Malayan agriculture, the following notes taken from Mr. Macgregor's article are of particular practical value.

The buffalo belongs to the same zoological family as the ox and the bison, but is not in the same genus. On bush and forest growth, sedge and reeds, it thrives better than the ox, but on good pasture grass or concentrated food it is usually inferior. It is normally kept with the object of rendering some return from otherwise useless pasture, though occasionally a local preference for its milk may make it a more profitable animal on intensive farms.

Though usually represented as savage, buffaloes are docile and easily managed—far more so, in fact, than other cattle. Their appearance is certainly fierce, but although nervous with strangers, they will usually try to avoid them by moving off rather than stand their ground. A buffalo cow with calf at foot will, naturally, be rather nervous and may be irritable, and occasionally an old bull will develop a bad temper which he will exhibit equally to his owner and to strangers, but neither of these eventualities is as common as it is with other cattle.

Domestic Buffaloes.

Domestic buffaloes are usually described as a "domesticated or degenerate species or type of the Arni or Indian buffalo". It seems strange, however, that so few writers have pointed out the very wide difference between the domesticated "swamp" buffalo, which is practically identical with the wild arni, and the domesticated "river" buffalo which has no wild prototype.

The Swamp Buffalo [*Buffelus asiaticus* (*paludestris*)].—This animal has a relatively short body with a large girth, short thin legs, and a short face; there is a small "shoulder hump" extending over the first eleven thoracic vertebrae and then terminating fairly abruptly; the horns grow out horizontally in the young animal and curl up in a semi-circle as age advances, but they always remain approximately in the same plane as the forehead. These horns are uniform in length and shape; *i.e.*, all swamp buffaloes of same age have approximately the same length and shape of horn. Domestic swamp buffaloes will mate with wild arni and produce fertile offspring.

The River Buffalo [*Buffelus asiaticus* (*riparius*)].—This animal has a relatively longer body, and a smaller girth than the swamp buffalo, with longer, thicker legs, and a longer face; the hump or dorsal ridge extends over the whole thoracic region, terminating gradually, and it is visible only in thin animals; the horns are, at first, directed downwards and backwards, thus showing the domed shape of the forehead, but sooner or later they curl upwards in a spiral with their long axes horizontal: thus the forehead and any part of the horn are never in the same plane; the length of the horn and its final shape vary in the different breeds. It can be noted that the spiral horn is heteronymous, *i.e.*, it is the left horn that has a right or corkscrew twist instead of the right horn as in African buffaloes.

* "The Domestic Buffalo" by R. Macgregor, F.R.C.V.S., G.V.S., Veterinary Officer, Pahang West. Abridged from a Thesis presented to the National Veterinary Medical Association of Great Britain and Ireland and published in *The Veterinary Record*, Vol. 53, No. 31, August 2, 1941.

There is very little evidence on the possibility of interbreeding between swamp and river buffaloes, but it is probable that crossing does occur, if only rarely. The two types, therefore, are almost certainly of the same species. Critical examination of the anatomical differences leads to the same conclusion.

Of the greatest importance is the difference in habit of the two types. The swamp buffalo is a more or less permanent denizen of marsh land, where it wallows in mud and feeds on the coarse marsh grass and reeds. The river buffalo is found more on dry ground. It appears to dislike mud and uses, where possible, rivers or ponds with firm bottoms in which to bathe. The two types are not miscible—a fact of considerable importance in the introduction of stud bulls for stock improvement. A river bull introduced into a herd of swamp buffaloes will be useless.

More attention has been paid to the selection of the river-type buffalo, which is therefore the type to be preferred if the country is equally suitable for either. As would be expected, with the improvement of the river-type stock, breeds have grown up, with advantages for the country in which they were developed.

The best-known of these breeds are the following :

(1) *Murrah* (Punjab).—Short curled horns. A general purpose animal suitable for milk or work.

(2) *Jaffrabarri* (West India).—Horns run down beside head in front of the ears. A heavy work animal, with poor milk capacity.

(3) *Mehsana and Surti* (Bombay Presidency).—Short horns, curled only to a semi-circle. A good milch animal, poor worker.

(4) *Mediterranean*.—Short horns. In northern climates a robe of hair is grown on the shoulders.

(5) *Rumanian*.—A dwarf version of the Mediterranean.

All the Indian breeds can easily be crossed and there is no reason to believe that this is not true of the Indian and Mediterranean, though the cross has not yet been made.

Domestic buffaloes are widely used at the present day in India, Burma, South China, Thailand, Malaya, Ceylon and the South Sea Islands. They have been tried in Australia, but were not a success and were allowed to revert to their wild state. The Mediterranean group is best represented in Egypt ; in Southern Italy the numbers kept are decreasing.

Sexual Systems.—The bull buffalo starts mounting at two years old, though he is usually rather too short for successful service until three years. By six or seven years there is frequently a loss of potency, with a rising proportion of unsuccessful services, but desire continues until he is twelve or more, during which time his muscular strength seems to increase. Complete senility, that is, loss of muscular strength as well as desire, does not set in till over 15. A good bull of river type can serve 100 cows a year, but it is unusual to allow more than 12 cows to each bull, as each of these will be served several times during her heat. There is no rutting season or periodic masculine desire, though the dietetic seasons affecting only the cows are usually attributed, quite wrongly, to the bulls.

The female organs of both types of buffalo resemble those of the ox, except that the cotyledons are fewer. The udder of the river buffalo is similar to that of the dairy cow in position and shape but never becomes very large ; that of the swamp buffalo is small and situated far back between the legs so that it cannot be seen from the side, while her teats never acquire any great length, no matter how often she is milked. Again this difference in shape and position can be attributed to artificial selection.

Despite the similarity in organs there are marked differences in the physiology of buffalo and ordinary dairy cows. Buffalo cows have a cycle of 28 days, with a

period of heat lasting from three to five days during which several services occur. In swamp buffaloes, desire seems to cease with daylight and mating usually occurs only at night.

The visible signs of heat may be inhibited by discomfort or malnutrition, and so, in areas where the nutritional value of the grazing varies with the time of year, a dietetic breeding season may occur, but cows slaughtered between the breeding seasons are found to be in all stages of their cycle, proving that the failure to mate is due to lack of desire and not to failure to ovulate.

The period of gestation is usually given as ten and a half months. Actually it averages 332 days, or eleven months in swamp buffaloes and 317 days in river buffaloes. After calving, buffaloes may be successfully served at the 42nd day but swamp buffaloes will often fail to come on heat so soon and are rarely served before the 65th day. The young cows of both types can be successfully served at two and a half years. Calving continues to extreme old age, and cows reputed to be 20 years old and to outward appearance fully this age, are often seen with well-fed calves at foot. Twins are not uncommon. The buffalo seems to be singularly free from obstetric trouble and rarely needs help at calving.

Lactation.—The period of lactation of the buffalo is variable, being influenced by the onset of pregnancy, the feeding and comfort of the animal and the amount of milk actually drawn. Naturally-fed buffaloes go dry about the sixth month of pregnancy, that is to say, seven to nine months after calving, but if pregnancy is delayed they may continue milking for a year. Well-fed river buffaloes of good milch breeds will lactate for 15 months if prevented from mating. The milk, when drawn under hygienic conditions, looks and smells like ordinary milk, but it is usual for it to acquire the peculiar odour of the buffalo and so become disagreeable to those not used to it.

Accurate milk records are difficult to obtain, as most owners allow the calf to suckle before milking. Most tables tend to show too low a figure for the quantity, and too high a figure for the fat content, as the calf has taken the first, less fatty milk. Swamp buffaloes have a daily yield of only six pints, leaving a very small margin over the necessities of calf rearing for the owner. Starvation is the normal fate of half the swamp buffalo calves whose dams are milked.

Well-fed river buffaloes yield up to two gallons per day, leaving a profitable surplus for the owner after calf rearing. This milk usually contains less than 8 per cent. fat, but river buffaloes of selected dairy strains may give as much as 11 per cent.

Buffalo milk is rarely consumed as whole milk. In Europe it is usually used for the preparation of butter or cream cheese, and in Asia for ghee. Ghee is prepared by curdling the milk and churning it thoroughly. The butter fat is skimmed off and heated to drive off all water, and strained through muslin to remove the protein. Little is left but pure fat. The butter milk from the first operation is used fresh. The ghee is bottled hot, and can be stored for several months. When unadulterated and uncooked it contains an appreciable amount of vitamin A, but its main nutritional value is as a fat. Ghee production is of greatest importance in rural areas where there is no distribution of vegetable fats, as factory products. In such districts the selection of good buffalo cows with high butter-fat yields is of primary importance.

Growth.—The calves can be weaned at five months, but remain at foot for two or three years if allowed to do so, so that it is a common sight to see a buffalo cow followed by two or even three young ones at different stages of growth. Growth continues till about the tenth year, but is slow after the fifth, at which age the working bulls are broken in and put to light work, the loads being increased as they develop. When fully grown, a swamp buffalo will weigh about $\frac{3}{4}$ ton, a cow of

the same age weighing ½ ton. River type buffaloes usually weigh rather more, but vary according to breed.

Both types are reputed to live till 25 years old or so, and from the appearance of some specimens there is no reason to doubt this.

Sensory Organs.—The buffalo has a dull sense of touch and of pain. Stinging insects are treated with comparative indifference, and serious wounds are well tolerated. The sight seems to be short, but is difficult to estimate on account of the stoical attitude of the animal. The hearing is good, and taste and smell appear to be of the same order as in oxen.

The Swamp Buffalo.

The inland areas of the Malay Peninsula consist of precipitous, forest-clad hills, intersected with valleys containing an alluvial soil. The rainfall is heavy and regular and the valleys are therefore naturally swampy or can easily be rendered so by damming the brooks that traverse them, but the lines between the swamp and the dry hillsides are sharply defined and are usually marked by a struggling collection of houses that constitutes a village.

The inhabitants of these villages are Malays whose traditional occupation is the growing of rice. They do not show much interest in animals, and usually content themselves with owning only sufficient buffaloes to work their plots. This usually means two or three head per person and at least one of these animals will be a bull. Except when actually working the plots, the buffaloes are left quite free and their behaviour can be observed with ease.

Naturally all the buffaloes of the village will collect into one herd, but a visitor arriving at mid-day will not see any sign of them, for the buffaloes are all in the swamps, lying asleep in their mud holes or wallows, with only their faces showing and even these covered with grey slime. About four o'clock in the evening, or earlier if it is raining, they emerge slowly from their mud holes, and start grazing on the reeds around. This grazing lasts until it is quite dark, after which they seek the drier ground on the hillside, and a period of distinct activity sets in. They can be heard, and sometimes seen, moving about freely, the cows bleating to the calves, and the bulls racing with each other, wrestling with their horns, and generally indulging in play, an amusing sight in such ungainly beasts. Shortly before dawn they return to the swamps and resume grazing till about ten in the morning, when they again seek their wallows. Usually each animal has its own wallow, and if one is not available it will soon dig one out with its hooves and horns. Sometimes the whole herd will crowd in together, lying with their chins on each other's backs. There they will lie ruminating and sleeping till evening.

The swamp buffalo is, in fact, a semi-aquatic nocturnal animal. If they are kept entirely on dry ground the calves become infested with parasites and are subject to joint-ill, and those which survive are weak and sickly. It is also important to note that swamp buffaloes cannot be driven along roads or across country in herds like other cattle, for if any attempt is made to drive them they make for the swamps and are soon lying in places inaccessible to man. They can be moved only by being led, one man to two or three animals, though the "man" may be a diminutive urchin if the buffaloes know him well.

Losses from tiger kills are not frequent, since on winding tiger the herd closes together, and the tiger will not readily attack such an assembly, of which each adult is more than his match in weight and strength.

Although about one-third of the herd consists of bulls, there is little fighting, and such as does occur is comparatively mild.

Management.—The calf running at foot has usually a ring of cord round the neck, with a piece hanging down to trip him up if he attempts to run away. This treatment

accustoms the animal to restraint. If the cow is to be milked, the calf is penned near the house overnight. The cow is caught at dawn, and driven between two converging rails. After allowing the calf to suckle for a few mouthfuls the rest of the milk is drawn, the milker sitting directly behind the animal. The cow and calf run free for the rest of the day. All the milk is consumed by the owner and there is no commercial dairying ; indeed, most cows are unmilked except by the calves.

At two years old the noses of both bulls and cows are pierced and ringed with a rotan ring. At five or six the poorer bulls are sold to the butcher and the best to timber haulage concerns. The main objection to castration lies in this need for hauling animals, for a castrate will not develop the large masculine hump and the heavy shoulders required.

The swamp buffalo is well suited to the puddling of the rice fields. They have the natural habit of stepping over the banks, on which river buffaloes would most certainly stand, destroying the irrigation system. The short thin legs of the swamp animal are also well adapted for wallowing along in the mud.

Buffaloes used for timber haulage are usually in the hands of Chinese. They are fed with a gallon or two of rice gruel per day in addition to their usual grazing. Draught buffaloes may become magnificent beasts, working ten hours per day (1 a.m. to 11 a.m.) and moving a dead weight of up to a ton.

Among other uses to which these animals are put are the working of water-raising wheels, towing barges in rivers and canals and puddling clay for building.

The River Buffalo.

River buffaloes are a comparatively recent introduction to Malaya and, at present, are kept only by the Northern Indian immigrants in the neighbourhood of the towns in which the ghee will find a ready sale. There are, nevertheless, many areas which would be suitable for their upkeep. They require shallow pools or rivers with fairly firm bottoms in which to lie for the mid-day period of rumination and sleep, and long grass or short bush on which to graze. When an area of inland, heavy timbered, forest is felled and the soil exposed to sunlight, a heavy and almost pure growth of lalang (*Imperata cylindrica*) becomes established, and persists for a considerable time. This grass, standing waist high, is siliciferous and coarse, and lacks phosphorus. It is of very little value for oxen, but river buffaloes appear to be able to maintain themselves upon it almost entirely. The new forest growth which follows the lalang still provides food for the buffalo until the green growth is too high for them to reach.

Apart from the love of wallowing the river buffalo has much the same habits as the ox. They are diurnal or can live under diurnal conditions ; they can be assembled and driven in herds ; and they take readily to artificial foods. In the settlements of Northern Indians in Malaya, advantage is taken of this, and buffaloes and oxen are farmed side by side. The herd is used entirely for milk production and the bulls are sent early to the abattoirs. None of the draught breeds have been at all widely used in Malaya.

Notes and Comments.

GROW MORE FOOD SHOW, SINGAPORE, 1941.

A four-day vegetable, fruit and flower show, held under the auspices of the Singapore Gardening Society at the Victoria Memorial Hall, Singapore, was opened by His Excellency the Governor, Sir Shenton Thomas, on 24th October, 1941.

In claiming that this show was the biggest of its kind ever held in Singapore, the organizers probably forgot or did not visit the Malayan Exhibition held in Singapore in 1922, when the total entries by far exceeded the one thousand, mostly vegetables, which were shown on the present occasion. However that may be, the Grow More Food Show of 1941 was most opportune and achieved its primary object of encouraging and extending interest in home gardening.

The Show was divided into two parts, each of two days, about half of the classes being exhibited on the first two days and the remainder on the last two days, so that the exhibits were fresh throughout the Show. In addition to classes for individual exhibits, special classes were provided open only to local English and Malay schools. The quality of the exhibits throughout was of a high standard and competition was keen.

As a subsidiary object the importance of good nutrition and a balanced diet was stressed by a large exhibit staged by the College of Medicine in conjunction with the Health Department, and at which several lectures were given daily by officers of the Health Department. The correct methods of cooking local foodstuffs were also demonstrated. The Gardens and Fisheries Departments each staged demonstration stalls and many local firms had advertising stalls. In addition two information bureaux, which proved very popular, gave advice on nutrition and vegetable growing.

THE RURAL LECTURE CARAVAN IN NEGRI SEMBILAN.

The Rural Lecture Caravan continues to do good service in disseminating information on agricultural matters in the outlying districts. For the greater part of the year it is in operation in one or another of the States. In June it visited eleven centres in Negri Sembilan. Films on agricultural and co-operative subjects were shown—interspersed with an occasional " short " of a popular nature—and lectures were given on a wide range of subjects, varied to suit the particular agricultural activity in each centre.

This tour proved to be one of the most successful in recent months. It is estimated that during the twenty-two shows given in the course of the tour not less than 20,000 people attended.

BROADCAST TALKS ON FRUIT GROWING.

Mr. D. G. Jones, Agricultural Officer, delivered the fifth and last of his talks on Fruit Growing over the Singapore Broadcasting Station on 5th November, 1941.

LEAFLET ON FODDER GRASSES.

Leaflet No. 8, Agricultural Series, on fodder grasses is superseded by Leaflet No. 23, the information on this subject having been entirely re-written as a result of recent research work at the Central Experiment Station, Serdang.

The present leaflet deals with the following five grasses, selected as being the most promising under Malayan conditions, viz., Guinea, Merker, Napier, Guatemala and Mauritius or Para. Methods of propagation and cultivation, yields and quality of each are discussed. This leaflet will be sent free in response to requests from residents in Malaya.

THE EFFECT OF COOKING ON THE NUTRITIVE VALUE OF VEGETABLES.

The public has been exhorted to grow more vegetables, and advice on methods to this end are now available. Perhaps, locally too little has been heard of how to cook vegetables. A pamphlet on " How to Cook Malayan Vegetables ", issued free by the Department of Information and Publicity gives much useful information, but the difficulty in Malaya is that it is almost impossible to bring together under one cover the methods which will be acceptable to the various nationalities in this country. The aim of cooking must obviously be to retain the nutritional value of the vegetable and at the same time to increase its palatability. Individual ideas on palatability vary, and while therefore we should leave each nationality to cook the vegetables to suit its own taste, propaganda should stress the guiding principles to be observed in order to retain the maximum nutritional value in the cooked vegetable.

An interesting paper on this subject by Mamie Olliver, M.Sc., F.I.C., appears in *Chemistry and Industry* of August 9th, 1941. The author summarizes the following simple rules to be observed :

(1) Vegetables should be used as soon as is practicable after harvesting.

(2) Waste in preparation of vegetables should be reduced to a minimum and, with green vegetables, only tough stems and badly wilted leaves should be removed. Root vegetables can be cooked either very thinly peeled or unpeeled.

(3) Green vegetables should be boiled rapidly for the shortest possible time in the minimum amount of water. The cooking liquor should be used for soups and gravies.

(4) Root vegetables can be boiled, steamed, baked, or fried, but the need for avoiding excess cooking applies as to green vegetables.

(5) " Keeping hot " of cooked green or root vegetables should be most rigorously avoided. This is probably the most important of all the factors considered.

(6) Salt is to be advised in the cooking of vegetables, since it improves the palatability of the tissue and does not increase the loss of nutritive value.

In conclusion, it should be stressed that it is not always possible to judge the nutritional value of a foodstuff from its chemical analysis. Questions of palatability and of digestion and absorption must also be taken into consideration. The effect of cooking on the digestibility of vegetables and on the absorption of the nutrient constituents of vegetables has been given too little study in the past. It is to be hoped that this aspect of vegetables as a food will receive more attention, so that the nutritional value of cooked vegetables can then be more fully assessed.

RUBBER STATISTICS.

The annual statistical compilation of the Statistics Department on acreage, production, imports, exports and consumption of rubber in Malaya, corrected up to the end of 1940, has recently made its appearance.

The total planted area of rubber in Malaya is now 3,480,989 acres, of which 356,552 acres is budgrafted, and production in 1940 was 549,327 tons.

Small holdings (of under 100 acres)—included in the above figures—are prominent, they total 1,361,128 acres (nearly 40 per cent.) and produced 214,919 tons (nearly 40 per cent.) of the rubber.

FERTILIZER PRICES, NOVEMBER, 1941.

The following are the prices current for the month of November 1941 of the more important fertilizers of which stocks are available :

	per ton	
Nitrate of soda	$185	
Rock phosphate (Christmas Island)	40	($36 Singapore).
Lime	15	

Quotations are *ex* warehouse, Port Swettenham, Klang, Singapore and Penang.

Supplies of muriate of potash, sulphate of ammonia, super-phosphate, basic slag, calcium cyanamide, sulphate of potash, and rock phosphate (Gafsa) are not available.

Departmental.

FROM THE DISTRICTS.

Compiled in the Office of the Chief Field Officer from Monthly Reports of Agricultural Officers.

October, 1941.

The Weather.

Very wet weather was experienced in the north of the country during the month, but conditions became progressively drier from north to south. Ten inches of rain were recorded at Ayer Itam, Penang Island in one day (8th) and extensive flooding was reported from the Kedah, Penang, Krian and Perak North Circles. In the southern States, however, rainfall was below average and drought conditions were reported from the Johore Central Circle.

Crop Reports.

Rubber.—Prices remained steady throughout the month and no change from the September figures was recorded. The continued high price of uncouponed rubber resulted in the previously recorded high rate of tapping being maintained. There was consequently a brisk demand for tappers.

Padi.—The crop has suffered some damage from floods in the north and from drought in the south.

It is reported that in some parts of north Kedah and Baling, short-term varieties are flowering, whereas in other parts of the same district planting is still in progress and, in Kuala Muda, considerable areas remain to be planted. Flooding was extensive during the second week of the month, but the water level fell before serious damage occurred, and it was possible to replant a considerable proportion of the damaged areas.

In Province Wellesley North and Central, the crop is making very good growth, though severe rat damage has been experienced in one Central *mukim*. In Penang Island, flood damage was widespread, but not heavy in any one area.

In the north of Krian, growth is good and planters are optimistic of a good season. In the south of the Circle, planting is still in progress.

In the Selama District planting is almost complete and growth is very promising. Throughout the Circle some flood damage was sustained but in no case was it serious.

From the Perak North Circle, growth of transplanted padi is reported to be excellent and an average or better than average crop is expected.

There are many fields in Upper Perak where planting is not yet completed but in the Kuala Kangsar and Parit Districts this operation is finished and the crop is growing well. Hill padi on the newly cleared area at Ayer Tawar is making excellent growth and there are prospects of a heavy crop.

In the Perak South Circle, planting and weeding operations were somewhat interfered with by the Puasa holidays, but the position is reported to be satisfactory.

The dry padi crop in Kelantan is making good growth, but lack of rain until late in the month held up operations on wet padi ; great activity is reported following the advent of rain.

Prospects are good at present in the Pahang North Circle, though operations are somewhat behindhand.

In the Pekan District of the Pahang East Circle transplanting in the riverine *mukims* is almost completed and, in general, growth is satisfactory, though some rat damage is reported. In the Kuantan District, transplanting is still in progress, and growth is improving as a result of regular rains and adequate water supplies.

Transplanting has been completed in the Bentong and Temerloh Districts of the South Pahang Circle and, in the latter District, flowering has started.

Harvesting is in progress in some parts of the Ulu Langat and Kuala Lumpur Districts; crop prospects are fairly good in other parts of Selangor, though the Sabak Bernam district is behind schedule as a result of water shortage until near the end of the month.

In Negri Sembilan there are prospects of a better than average season in most districts; weeding is in progress in the Kuala Pilah District and also in the area between Seremban and the coast.

In the inland districts of Malacca there is promise of an excellent crop, water supplies having been adequate and no reports of pests damage having yet been received. There has been some loss of nurseries in the coastal districts due to acid water conditions.

Some concern is felt for the crop in the Segamat District of the Johore North Circle owing to lack of water.

A disappointing season so far is reported from the Johore Central Circle due partly to dry weather and partly to the counter attractions of rubber at the present time, resulting in lack of interest in padi cultivation. In the Batu Pahat District harvesting is in progress but damage by rats and birds has contributed to low yields. In the Endau District, drought and the Puasa holidays have held up progress and transplanting is not yet completed.

The Johore South Circle reports a smaller planted acreage due to the attraction of rubber.

Transplanting has been completed in most areas and growth is good.

Planting of dry padi has been completed in Brunei and a large increase in the area planted is anticipated. Shortage of water has seriously delayed transplanting of wet padi.

Fruit.—Mangoes are being harvested at Kulim, Kedah, and mangosteens and rambutans are ripening; mangoes are also reported to be plentiful in the Perak Central Circle, but of an inferior quality. Durians are on the market at Parit, Perak. Mangoes and rambutans are in bearing in the South Pahang Circle, but are not yet ripening.

In the Johore Central Circle the main crop of durian, rambutan and mangosteen are ripening but prospects are poor; in Singapore, however, prospects for the fruit crop are fairly good.

Tobacco.—Further planting continues in Penang and Province Wellesley, but crops are reported to be poor. A fall in price in both the Perak Central and Malacca Circles has not had the effect of curtailing planting, and an increase in the planted acreage is also reported from the Pahang South Circle.

Food Crops.—The acreage under rice substitute crops continues to increase.

Poultry.—A scarcity of both poultry and eggs is reported from Penang and Province Wellesley, Pahang East and Central Johore and prices in these localities have risen in consequence.

Coconuts.—A new coconut oil mill has been opened at Simpang Morib, Selangor, with a daily output of 70 gallons of oil. It is also reported from Malacca that coconut oil for local sale is being manufactured on an increasing scale in coastal villages.

MARKET PRICES.

October, 1941.

Rubber.—During October there has been no variation in the price of rubber on the Singapore market. No. 1.X. Ribbed Smoked Sheet remained steady at $38\frac{5}{8}$ cents per lb. On the London and New York markets, however, there was a steady though slight appreciation. The London daily price rose from $13\frac{5}{8}$ to $13\frac{3}{4}$ pence per lb. whilst the New York daily price for the month opened at $22\frac{1}{2}$ cents gold per lb. and closed at $23\frac{1}{8}$ cents.

The average of daily quotations per lb. were, Singapore 38.63 cents, London 13.74 pence, and New York 22.92 cents gold as compared with 38.63 cents, 13.67 pence and 22.5 cents gold in September.

Prices paid for small-holders' rubber at two centres during the month are given in Table I.

Table I.

Weekly Prices Paid by Local Dealers for Small-holders' Rubber, October, 1941.

(Dollars per picul of 133 1/3 lbs.)

Grades	Kuala Kangsar, Perak					Kuala Pilah, Negri Sembilan				
	1	8	15	22	29	2	9	16	23	30
Smoked Sheet ..	44.92	44.51	44.21	45.02	45.00	45.10	45.10	44.41	44.50	45.45
Unsmoked Sheet	40.10	40.00	41.84	39.90	41.33	42.50	—	42.00	—	41.00
Scrap	—	—	—	—	—	—	—	—	—	29.00

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8 per ton.
Transport from Kuala Kangsar to Prai by railway $6.20 per ton.
At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.

Palm Oil.—No recent information is available regarding prices paid in the United Kingdom for Malayan palm oil.

Local sales of palm oil in sellers' drums were made during September at the following prices per ton :—unbleached oil 5 per cent. f.f.a., f.o.b. Singapore, delivery during October 1941, $170; unbleached oil 5 per cent. f.f.a., f.o.b. Singapore, delivery during November 1941, $172.50.

Tea.—There are no London tea sales.

The latest Colombo prices available, quoted from *The Ceylon Tea Market Report* of 18th October, 1941 of the Colombo Brokers' Association, are as follows, in rupees per lb.: High Grown Rs. 1.50, Medium Grown Rs. 1.35, Low Grown Rs. 1.23.

Cardamoms.—Green cardamoms were quoted in *The Ceylon Chamber of Commerce Weekly Report* of 18th October, 1941, from Rs. 2.00 to Rs. 2.30 per lb.

Derris.—There has been little change in the prices of this product since September. Owing to the demands of the American market trade has been brisk.

Table II.

Singapore Prices of Various Agricultural Products.

Product	October, 1941 Highest	October, 1941 Lowest	October, 1941 Average	September, 1941 Average	Average Price 1940
	per picul $	per picul $	per picul $	per picul $	per picul $
Copra :					
Sundried	2.90	2.90	2.90	2.81	3.08
Mixed	2.65	2.65	2.65	2.56	2.76
Coconut Oil	..	..	12.00‖	10.50‖	8.29
Copra Cake No. 1	2.55	2.55	2.55	2.55	1.43
No. 2	2.30	2.30	2.30	2.30	‡
Pineapples, Canned :*					
G.A.Q. : Cubes	4.85	4.85	4.85	4.85	4.85
Sliced	4.80	4.80	4.80	4.80	4.80
Tall	4.95	4.95	4.95	4.95	4.95
Golden : Cubes	5.45	5.45	5.45	5.45	5.45
Sliced	5.40	5.40	5.40	5.40	5.40
Tall	5.55	5.55	5.55	5.55	5.55
Coffee :					
Liberian	18.50	18.50	18.50	18.40	16.10
Excelsa	14.50	14.50	14.50	14.80	13.69
Robusta	12.50	12.50	12.50	12.80	8.92
Palembang	23.00	21.50	21.70-22.75	21.00-22.56	13.00†
Sourabaya	24.50	22.75	22.95-24.20	21.75-23.56	14.80†
Arecanuts :					
Best	11.75	11.50	11.63	10.56	5.65
Medium	11.25	11.00	11.13	9.69	5.24
Mixed	10.75	10.50	10.63	8.96	4.88
Splits	7.75	5.00	5.15-7.50	5.51-8.56	6.33†
Red Whole	7.75	5.50	5.95-7.50	5.37-8.69	6.67†
Sliced	18.00	14.50	15.15-17.90	9.62-11.75	10.79†
Pepper :					
Singapore Black	8.00	8.00	8.00	8.00	7.29
Singapore White	17.75	17.50	17.63	17.00	‡
Muntok White	18.25	18.00	18.13	17.50	13.51
Nutmegs :					
110's	24.75	24.00	24.56	26.06	26.11
80's	25.50	25.00	25.38	28.00	30.65
Penang, dried¶	..	..	17.00	17.00	21.00
Mace :					
Siouw	‡	‡	‡	‡	‡
Amboina	45.00	40.00	42.75	48.00	39.85
Penang, dried¶	..	..	50.00	50.00	63.50
Cloves :					
Zanzibar	45.00	42.50	43.75	42.50	‡
Amboina	44.00	43.00	43.50	43.00	‡
Penang, dried¶	‡	‡	‡	‡	72.00
Gambier :					
Block	‡	‡	‡	‡	‡
No. 1 Cube	13.00	13.00	13.00	13.00	15.00
Sago :					
Pearl	8.37½	8.25	8.36	8.39	7.79
Flour, Sarawak Fair	5.00	4.75	4.88	4.69	4.95
Tapioca :					
Flake Fair	9.50	9.25	9.38	9.33	8.08
Seed Pearl	9.25	9.25	9.25	9.34	9.45
Medium Pearl	10.25	10.00	10.19	10.75	9.07

* per case of 48 cans of 1½ lbs. each. † Highest of the average monthly range quotations. ¶ Penang prices.
‡ Not quoted. ‖ in new drums.

Rice.—The Singapore average wholesale prices of rice per picul in September were as follows :—Thailand 3rd Grade "A" $8.97, Thailand Broken 1st Grade "A" $7.47, Thailand Broken 2nd Grade "A" $7.22, Burma S.Q. Meedone $6.82, Burma Parboiled Milchar No. 2 $5.92, Annam White Rice No. 1 was not quoted.

The August retail price of No. 2 Thailand rice in Penang was 54 cents per gantang (gallon). Singapore and Malacca prices were not quoted.

The average declared trade value of imports during August was $7 per picul as compared with $6.54 in July.

Padi.—The Government Rice Mills, Perak, are still paying a guaranteed price of $2.50 per picul for padi, plus a bonus of 10 cents per picul for pure strain S.K. 48 padi.

Retail prices of padi in cents per gantang (gallon) were as follows : Penang and Province Wellesley 14 ; Krian 14 ; Perak Central 15 to 20 ; Perak South 16 to 20 ; Kelantan 21.50 ; Pahang North 20 to 24 ; Pahang South 22 to 25 ; Malacca 16 to 20 ; Kedah 11.

Tobacco.—Prices and prepared tobacco in Kelantan were, 1st quality $110 to $150, 2nd quality $100 to $120, 3rd quality $60 to $90. Prices of dried leaf per pikul were as follows ; Kedah $65 to $70 ; Penang and Province Wellesley, 1st quality $59, 2nd quality $47, uncured $7 ; Perak Central, 1st quality $43 to $50, 2nd quality $25 to $40, 3rd quality $28 to $34 ; Kuala Kangsar $12 ; Perak South, 1st quality $45 to $58, 2nd quality $35 to $50, 3rd quality $20 to $40, prepared tobacco $80 to $130 ; Pahang North, 1st quality $40 to $80, 2nd quality $30 to $70, 3rd quality $21 to $50 ; Pahang South, Bentong, $45 to $55 ; Malacca $40 ; Temerloh $192 ; Selangor cut tobacco $2 to $2.50 per kati.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore daily prices for copra, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports and certain coffee prices are kindly supplied by Guthrie & Co., Ltd., Kuala Lumpur, local palm oil prices by Whittall & Co., Kuala Lumpur, the Singapore prices of imported coffee and arecanuts by Lianqui Trading Company of Singapore, and Singapore derris prices by Hooglandt & Co., Singapore.

1 picul=133 1/3 lbs. The dollar is fixed at 2*s.* 4*d.*

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Trafalgar Square, London, W.C.2.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates.)

Month 1941	Palm Oil			Palm Kernels		
	F.M.S.	U.M.S.	Malaya	F.M.S.	U.M.S.	Malaya
January	1,872.7	1,221.4	3,094.1	170.3	150.0	320.3
February	1,698.3	993.2	2,691.5	167.1	179.3	346.4
March	2,179.8	1,710.1	3,889.9	180.5	274.9	455.4
April	1,993.0	1,870.8	3,863.8	176.3	204.0	380.3
May	1,878.0	2,022.3	3,900.3	95.2	219.0	314.2
June	2,763.7	2,173.9	4,937.6	63.0	214.0	277.0
July	3,164.9	2,611.9	5,776.8	44.7	141.0	185.7
August	3,259.8	2,562.3	5,822.1	18.0	—	18.0
September	2,406.1	2,206.2	4,612.3	35.2	—	35.2
Total ..	21,216.3	17,372.1	38,588.4	950.3	1,382.2	2,332.5
Total January to September, 1940	22,727.0	21,263.4	43,990.4	3,565.2	3,828.1	7,393.3
Total for the year 1940 ..	29,875.2	28,096.9	57,972.1	4,513.1	5,098.1	9,611.2

Stocks on estates as at 30th September, 1941, were : palm oil 3,385 tons, palm kernels 1,409 tons.

MALAYAN AGRICULTURAL EXPORTS, JULY, 1941.

Product	Net Exports in Tons				
	Year 1940	Jan./July 1940	Jan./July 1941	July 1940	July 1941
Arecanuts	43,915	28,261	19,452	5,701	2,177*
Coconuts fresh†‡ ..	131,469†	53,508†	123,121†	11,908†	17,129†
Coconut oil‡	69,446	37,992	45,187	4,219	4,971
Copra‡..	9,904*	6,584	22,260*	4,522*	2.427*
Copra cake	1,215*	4,370	5,920*	28*	35
Gambier, all kinds ..	821	494	210	63	45
Palm kernels	9,219	5,129	1,700	404	—
Palm Oil	55,990	27,626	24,870	1,934	1,579
Pineapples, canned ..	40,243	30,949	11,291	3,079	1,767
Rubber¶	549,327¶	308,503¶	344,491¶	47,882¶	57,261¶
Sago,—flour	2,525	208*	2,445*	4,061*	918*
„ —pearl	4,848	2,078	3,893	179	402
„ —raw	4,816*	3,627*	3,035*	488*	757*
Tapioca,—flake ..	762	454	375	29*	51
„ —flour ..	2,649*	1,351*	1,650*	293*	407*
„ —pearl ..	17,004	8,882	11,731	1,370	1,104
Derris	1,258	797	602	115	121
‡Copra equivalent ..	108,468	69,392	53,630	861	5,993

† hundreds in number. * net imports. ¶ production.

MALAYAN RUBBER STATISTICS.

Acreages of Tappable Rubber actually Tapped and not Tapped on Estates of 100 Acres and over, for the Month Ending 30th September, 1941.

Area	Estimated Acreages of Tappable Rubber (9)+(11)	Acreages of Tappable Rubber not Tapped				Area of tappable rubber never been tapped (b)		Total area not tapped (3)+(5) (c)		Total area tapped during the month (c)		Area of tappable rubber rested under rotational systems (c)	
		On estates which have entirely ceased tapping		On estates which have partly ceased tapping (a)									
		Acreage	Percentage of (3) to (2)	Acreage	Percentage of (5) to (2)	Acreage	Percentage of (7) to (2)	Acreage	Percentage of (9) to (2)	Acreage	Percentage of (11) to (2)	Acreage	Percentage of (13) to (2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Straits Settlements—													
Province Wellesley ..	41,972	nil	nil	4,151	9.9	309	0.7	4,151	9.9	37,821	90.1	7,129	17.0
Malacca	108,274	120	0.1	5,135	4.8	671	0.6	5,255	4.9	103,019	95.1	15,067	13.9
Penang	2,720	nil	nil	505	18.6	35	1.3	505	18.6	2,215	81.4	60	2.2
Singapore	28,596	1,615	5.6	4,707	16.5	431	1.5	6,322	22.1	22,274	77.9	1,648	5.8
Total S.S. ..	181,562	1,735	0.9	14,498	8.0	1,446	0.8	16,233	8.9	165,329	91.1	23,904	13.2
Fed. Malay States—													
Perak	269,145	445	0.1	10,174	3.8	2,078	0.8	10,619	3.9	258,526	96.1	30,783	11.4
Selangor	295,046	986	0.3	10,620	3.6	2,004	0.7	11,606	3.9	283,440	96.1	26,789	9.1
Negri Sembilan ..	241,738	1,359	0.6	15,607	6.4	2,236	0.9	16,966	7.0	224,772	93.0	19,559	8.1
Pahang	84,069	688	0.8	5,030	6.0	1,756	2.1	5,718	6.8	78,351	93.2	2,699	3.2
Total F.M.S. ..	889,998	3,478	0.4	41,431	4.6	8,074	0.9	44,909	5.0	845,089	95.0	79,830	9.0
Unfed. Malay States—													
Johore	462,737	2,788	0.6	27,168	5.9	12,579	2.7	29,956	6.5	432,781	93.5	43,502	9.4
Kedah	192,816	1,841	1.0	7,992	4.1	2,257	1.2	9,833	5.1	182,983	94.9	21,316	11.1
Kelantan	30,488	403	1.3	4,519	14.8	1,000	3.3	4,922	16.1	25,566	83.9	1,820	6.0
Trengganu (d) ..	4,817	nil	nil	nil	nil	nil	nil	nil	nil	4,817	100.0	1,738	36.1
Perlis (e)	1,337	nil	nil	190	14.2	89	6.7	190	14.2	1,147	85.8	274	20.5
Brunei	6,211	nil	nil	1,030	16.6	211	3.4	1,030	16.6	5,181	83.4	758	12.3
Total U.M.S. ..	698,406	5,032	0.7	40,899	5.9	16,136	2.3	45,931	6.6	652,475	93.4	69,408	9.9
Total MALAYA ..	1,769,966	10,245	0.6	96,828	5.4	25,656	1.4	107,073	6.0	1,662,893	94.0	173,142	9.8

Notes :—(*a*) Area out-of-tapping on estates which have partly ceased tapping refers to areas definitely being rested and excludes areas on any tapping round.

(*b*) The acreage shown in column (7) is included in columns (3) and (5).

(*c*) Areas of tappable rubber rested under rotational systems are not considered as out-of-tapping and therefore columns (11) and (12) include columns (13) and (14) respectively.

(*d*) Registered companies only.

(*e*) Figures for the quarter ending 30th June, 1941.

MALAYAN RUBBER STATISTICS. Table I.

Acreage, Stocks, Production, Imports and Exports of Rubber, including Latex, Concentrated Latex and Revertex, for the Month of September, 1941, in Dry Tons.

State or Settlement	Stocks at beginning of month (a)			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres (b)		Imports				Exports (including re-exports)				Stocks at end of month			Consumption	
								During the month		January to September, 1941, inclusive		During the month		January to September, 1941, inclusive						
	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to Sept., 1941, inclusive	during the month	Jan. to Sept., 1941, inclusive	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	Jan. to Sept., 1941, inclusive
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
Malay States :—																				
F.M.S.	..	8,210	15,112	17,374	144,742	7,257	74,836	Nil	Nil	Nil	Nil	13,853	13,311	120,266	103,723	..	5,905	14,736	148	1,302
Johore	..	3,923	6,279	8,235	68,730	10,035	55,273	Nil	57	Nil	368	4,767	10,424	25,127	95,078	..	7,247	6,091	..	..
Kedah	..	899	3,625	4,189	35,281	1,542	14,844	Nil	Nil	Nil	Nil	1,403	4,263	11,186	39,403	..	917	3,672	..	..
Perlis	..	41	35	23	192	43	314	Nil	Nil	Nil	Nil	Nil	79	Nil	509	..	38	25	..	..
Kelantan	..	362	664	524	4,307	660	5,865	Nil	Nil	Nil	Nil	229	1,009	1,788	8,135	..	362	610	..	..
Trengganu ..	..	91	160	232	1,887	421	3,696	Nil	Nil	Nil	Nil	8	726	28	5,547	..	31	139	..	..
Brunei	..	21	81	74	614	146	1,060	..	..	..	..	..	275	..	1,671	..	Nil	47	..	..
TOTAL MALAY STATES	..	13,547	25,956	30,651	255,753	20,104	155,888	Nil	57	Nil	368	20,260	30,087	158,395	254,066	..	14,500	25,320	148	1,302
Straits Settlements :—																				
Malacca	..	2,369	1,518	1,768	14,325	1,302	8,325	Nil		Nil		4,634		29,012		..	2,971	1,660	..	..
Province Wellesley ..	..	2,057	771	674	5,604	385	2,620	Nil		Nil		17,026		111,790		..	771	724	..	..
Penang Island ..	4,601	3,851	22	30	238	214	1,145	506	30,960	10,806	251,806	47,304	Nil	334,532	Nil	2,536	3,076	23	..	..
Singapore Island	15,524	20,944	298	207	1,823	287	1,481	18,326		187,158		Nil		Nil		10,871	16,514	287	31	272
Labuan	..	20	Nil	Nil	Nil	27	161	68		584						..	43	Nil	..	..
TOTAL STRAITS SETTLEMENTS ..	20,125	29,241	2,609	2,679	21,990	2,215	13,732	18,900	30,960	198,548	251,806	68,964	Nil	475,334	Nil	13,407	23,375	2,694	31	272
TOTAL MALAYA ..	20,125	42,788	28,565	33,330	277,743	22,319	169,620	18,900	31,017	198,548	252,174	89,224	30,087	633,729	254,066	13,407	37,875	28,014	179	1,574

Table II.
DEALERS' STOCKS IN DRY TONS. (c)

Class of Rubber	Federated Malay States	S'pore	Penang	Province W'sly, Malacca, Labuan and Brunei	Johore	Kedah
(22)	(23)	(24)	(25)	(26)	(27)	(28)
DRY RUBBER ..	5,050	15,360	2,772	2,969	5,297	361
WET RUBBER ..	855	1,144	304	816	1,950	556
TOTAL ..	5,905	16,514	3,076	3,785	7,247	917

Table III.
FOREIGN EXPORTS IN DRY TONS.

Ports	For month	Jan. to Sept., 1941, inclusive
(29)	(30)	(31)
Singapore ..	57,762	428,026
Penang ..	19,566	135,384
Port Swettenham	11,178	69,379
Malacca	718	940
TOTAL ..	89.224	633,729

Table IV.
DOMESTIC EXPORTS IN DRY TONS. (d)

Area.	For month	Jan. to Sept., 1941, inclusive
(32)	(33)	(34)
Malay States ..	50,239	411,763
S. Settlements ..	4,349	35,236
MALAYA ..	54.588	446,999

Notes :—(a) Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

(b) For F.M.S. & U.M.S. the production of estates of less than 100 acres is estimated from the formula. Production + imports + stocks at beginning of month = Exports + stocks at end of month + consumption ; *i.e.*, Column (7) = Columns (13) + (14) + (17) + (18) + (19) + (20) − (2) − (3) − (4) − (5) − (9) − (10).
For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.

(c) Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios : unsmoked sheet, 15% ; wet sheet, 25% ; scrap, lump, etc., 40% ; stocks elsewhere are in dry weights as reported by the dealers themselves.

(d) Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands, are represented by sales or exports as shown by cess paid.

(e) All statements are brought up to date monthly, and any inaccuracies that may be disclosed are corrected in the totals ; the latest publication, therefore, is always the most reliable.

(f) The above with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. & F.M.S., at Singapore on 29th October, 1941.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1941.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall							Bright Sunshine		
	Means of			Absolute Extremes								Number of days							
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet	Total	Most in a day Amt.	Precipitation, .01 in or more	Precipitation, .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
	°F	°F	°F	*	*	*	*	°F	°F	in.	mm.	*						hrs.	hrs.	
Kuala Lumpur Aerodrome, Selangor	89.9	72.4	81.1					83.7	85.6	20.05	509.3		21	16	11	7	2	190.50	6.35	52
Port Swettenham Aerodrome, Selangor	88.8	71.6	80.2					85.1	86.6	13.17	334.5		14	14	6	—	—	199.00	6.63	55
Sitiawan, Perak	88.4	73.5	80.9					84.3	85.8	5.16	131.1		17	11	6	—	—	189.65	6.32	52
Ipoh Aerodrome, Perak	89.6	72.6	81.1					83.3	85.0	14.70	373.4		21	17	6	—	—	181.95	6.07	50
Temerloh, Pahang	91.1	73.2	82.1					86.2	87.6	7.59	192.8		16	14	3	9	—	201.55	6.72	55
Kuala Lipis, Pahang	89.5	72.0	80.7					84.2	85.9	8.64	219.5		17	15	6	30	1	190.70	6.36	53
Kuala Pahang, Pahang	88.1	73.9	81.0					89.0	89.8	5.57	141.5		9	8	1	—	2	240.35	8.01	66
Kallang Aerodrome, Singapore ..	87.5	76.8	82.1					84.5	85.5	2.98	75.7		11	8	—	—	—	217.85	7.26	60
Bayan Lepas Aerodrome, Penang ..	86.7	74.5	80.6					84.5	85.4	13.88	352.6		23	19	2	—	—	174.65	5.82	49
Malacca Town, Malacca	85.8	73.7	79.7					84.9	85.5	4.76	120.9		16	10	3	—	—	208.70	6.96	57
Kluang, Johore	89.0	70.8	79.9					81.9	83.4	5.05	128.3		17	12	3	8	—	195.45	6.51	54
Mersing, Johore	88.5	71.5	80.0					84.5	84.4	3.47	88.1		10	6	3	—	2	213.80	7.13	59
Alor Star, Kedah	87.6	74.1	80.9					85.4	86.6	10.57	268.5		19	13	—	1	—	203.40	6.78	56
Kota Bahru, Kelantan	90.4	73.6	82.0					85.5	86.2	7.01	178.1		12	11	4	1	—	211.10	7.04	57
Kuala Trengganu, Trengganu ..	88.8	72.5	80.7					85.6	86.7	8.91	226.3		8	5	4	—	2	251.15	8.37	69
Labuan	87.7	76.1	81.9					85.8	87.9	18.62	472.9		20	17	5	—	1	223.75	7.46	62
HILL STATIONS.																				
Fraser's Hill, Pahang 4,268 ft. ..	74.7	62.2	68.5					72.9	73.2	10.80	274.3		19	16	—	11	1	162.05	5.40	45
Cameron Highlands, Tanah Rata, Pahang 4,750 ft.	72.3	56.4	64.3					71.4	71.4	13.70	348.0		23	20	2	2	—	121.85	4.06	33
Cameron Highlands, Rhododendron Hill, Pahang 5,120 ft. ..	71.4	59.5	65.5					..	..	13.91	353.3		22	19	1	1	1	145.80	4.86	40

* Restrictions have been placed on the supply of certain types of Meteorological Informations.